WELSH SLATE
Part of the Breedon Group

Welsh Slate, Penrhyn Quarry, Bethesda, Bangor,
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EN 12326-1:2014

Reference of this commercial document:	IMSD 8.2.4-23b	Date of issue	May 2018 (Issue 2)
Commercial document issued by: Welsh Slate, Penrhyn Quarry, Bethesda, Bangor, Gwynedd, LL57 4YG United Kingdom			
Location of quarry: Cwt-y-Bugail Slate Quarry, Llan Ffestiniog, Blaenau Ffestiniog, Gwynedd, LL41 4RF			
This document records the conformity of the product described below and is incomplete without the explanation of the meaning of the test results and the requirements of EN 12326-1:2014. The tests referred to and the criteria are contained in EN 12326-1:2014 and EN 12326-2:2011			
Date of sampling	December 2017	Date of testing	Jan - April 2018
Product description and commercial name Relation between bedding and cleavage	Cwt-y-Bugail County Roofing Slate 500x250mm Beds parallel to cleavage		Conformity
1. Dimensional tolerances			
Format	Rectangular		
Deviation from declared length		±0mm	YES
Deviation from declared width		±0mm	YES
Deviation from declared squareness		0.3%	YES
Deviation from straightness of edges		1.0mm	YES

Slate type for deviation of flatness	Very flat	Flat (Capital)	Normal (County)	Non-flat (Celtic)	
Deviation from flatness	0.1%				YES
2. Thickness					
Nominal thickness and variation of individual thickness against nominal thickness	7.0mm, ± 35%				YES
3. Strength					
Characteristic MoR	Transverse	38.7 N/mm²	Longitudinal	77.8 N/mm²	NR

4. Water absorption		Code W1 (≤0.6): 0.29%	YES
5. Freeze thaw			NR
6. Thermal cycle test		T1	YES
7. Apparent calcium carbonate content		0.00%	YES
8. Sulfur dioxide exposure tests	≤ 20% apparent calcium carbonate	S1	YES
	> 20% apparent calcium carbonate		NA
9. Non-carbonate carbon content		1.0%	YES
10. External fire exposure	Deemed to satisfy class B_{ROOF}		YES
11. Reaction to fire	Deemed to satisfy class A1		YES
12. Release of dangerous substances	None in conditions of use as roofing or external cladding		NR

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Date of sampling and testing	If more than one date is applicable to sampling or testing they should be indicated against the individual test results
Product description	Slate for roofing and external cladding or carbonate slate for roofing and external cladding. Slate type and origin
1. Dimensional tolerances	
Length and width	Maximum deviation ± 5mm
Deviation from squareness	Maximum deviation ± 1% of the length
Deviation from straightness of edges	Slate length ≤ 500mm Permitted deviation ≤ 5mm
	Slate length > 500mm Permitted deviation ≤ 1% of the length

Flatness : The limits of deviation from the flatness are defined for four types of slate. The bevelled edges shall be applied to the convex face. Slates with deviation from flatness in excess of the limit may be used for special applications.

Slate type	Maximum deviation from flatness as a % of the slate length
Very flat	< 0.9
Flat	< 1.0
Normal	< 1.5
Non-flat	< 2.0

2. Thickness:	The basic nominal thickness is determined as a function of the bending strength using the formulae given in 3, local climate conditions and traditional construction techniques. The basic nominal thickness is increased in relation to the slates performance in the appropriate sulfur dioxide test (if required) as shown in 7 and 8 below.
3. Strength:	Longitudinal and transverse characteristic modulus of rupture; there is no limit for characteristic modulus. However the basic nominal thichness is determined as a function of the bend strength using the formulae given below, local climate conditions and traditional construction techniques.

$$el = X\sqrt{\frac{l}{Rcl}}$$

and

$$et = X\sqrt{\frac{b}{Rct}}$$

Where

el is the longitudinal thickness , (in mm);

et is the transverse thickness, (in mm);

l is the length of the slate, (in mm);

b is the width of the slate, (in mm);

Rcl is the characteristic longitudinal modulus of rupture, (in N/mm²);

Rct is the characteristic transverse modulus of rupture, (in N/mm²);

X is a constant determined as a function of climate and the traditional construction techniques (in N½.mm-½). NOTE: It may be different for each formula and is selected for the member state of use according to the table below.

National X Factors:

Member state	Transverse	Longitudinal	Member state	Transverse	Longitudinal
Belgium	1.0	1.0	Czech Repub.	1.2	1.2
Ireland	0.9	1.1	Italy	1.2	1.2
France	1.0	1.0	Spain	1.0	1.0
Germany	1.2	1.2	UK	0.9	1.1

Those member states that have not declared a national value should select a value or pair of values in relation to their countries climate and traditional construction techniques. It should not be less than the minimum value or pair of values given above.

el and et are determined by using the length *l* and the width b of the slates. The maximum value determined is the basic individual thickness of the slate, ebi. The basic individual thickness is increased in relation to the slates performance in the appropriate sulphur dioxide test as shown in 7 and 8 below.

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4. Water Absorption:	Code W1 (≤0.6), W1 (>0.6), or W2
5. Freeze-thaw test:	Slates tested indicate the mean value of the modulus of rupture after 50 cycles in transverse and longitudinal directions before and after the freeze/thaw test, if relevent, (test (if W1(>0.6)), or not required.
6. Thermal cycle test:	The following table explains the meaning of the test codes

Code	Observation in the test	Conformity to the standard
T1	No changes in appearance. Surface oxidation of metallic minerals. Colour changes that neither affect the structure nor form runs of discolouration.	Acceptable
T2	Oxidation or appearance changes of the metallic inclusions with runs of discolouration but without structural changes.	Acceptable
T3	Oxidation or appearance changes of the metallic minerals which penetrate the slate and risk the formation of holes.	Acceptable subject to the note below

NOTE : It is best only to use slates within code T3, which potentially may result in water penetration selectively with suitable methods of construction that avoid such penetration. Slates showing exfoliation splitting or other structural changes in this test are not acceptable.

7. Apparent calcium carbonate content:	There is no limit on apparent calcium carbonate content. However, the apparent calcium carbonate content determines which sulfur dioxide exposure test procedure should be carried out and, together with the strength, the minimum nominal thickness of the product. If the carbonate content is less than or equal to 20% then the sulfur dioxide exposure test procedure in EN 12326-2:2011, 14.1 applies. If the carbonate content is more than 20%, the sulfur dioxide exposure test procedure in EN 12326-2:2011, 14.2 applies. The minimum thickness is calculated using the table below.

8. Minimal nominal thickness in relation to apparent calcium carbonate content and sulfur dioxide exposure code

Carbonate content %	SO2 exposure test code from EN 12326-2:2011, 14.1	Depth of softened layer from EN12326-2:2011, 14.2	Thickness adjustment
≤ 5.0	S1		None
	S2		ebi + 5%
	S3		ebi ≥ 8.0mm or switch to the test in EN 12326-2:2011, 14.2
> 5.0	S1		ebi + 5%
	S2		ebi + 10%
≤ 20.0	S3		ebi ≥ 8.0mm or switch to the test in EN 12326-2:2011, 14.2
> 20.0		0mm to 0.70mm	ebi + 0.50mm + 7t²

ebi is the basic individual thickness obtained from 3 above (in mm)

t is the thickness of the softened layer obtained from EN 12326-2:2011, 14.2 (in mm)

9. Non-carbonate carbon content: The non-carbonate carbon content shall be less than 2%

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CE Marking

Welsh Slate roofing products conform to the requirements of the CE mark.

The following table provides the necessary information required to demonstrate conformity of

Cwt-y-Bugail County Roofing Slate

CE 0086	
Welsh Slate Ltd, Penrhyn Quarry, Bethesda, Near Bangor, Gwynedd, Wales, UK, LL57 4YG	
12	
002CQ-DoP2014-11-03	
EN 12326-1:2014	
Cwt-y-Bugail County	
Intended to be used as discontinuous roofing and external cladding	
Dimensional variation	
Nominal thickness	7.0mm
Individual thickness	7.0mm (< +/- 35%)
Deviation of length and width	Complies
Deviation of edge straightness	Complies
Deviation of rectangularity	Complies
Mechanical resistance (Characteristic modulus of rupture)	
Transverse	38.7 N/mm²
Longitudinal	77.8 N/mm²
Water permeability - water absorption	**W1** (≤0.6%)
Apparent calcium carbonate content	≤ 5%
Durability	
Water absorption	**W1** (≤0.6%)
Freeze-thaw cycling	Not required
Thermal cycling	**T1**
Sulfur dioxide exposure	**S1**
Non-carbonate carbon content	Complies: ≤ 2%
Release of dangerous substances: None in conditions of use as roofing or external cladding	
External fire performance: Deemed to satisfy	